

Riparian Buffer Station

Virginia Science SOLs 6.1, 6.7, 6.9, LS.1, LS.4, LS.12

Key Concepts	interaction of living organisms and their environment, physical water quality monitoring and natural resource management
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Vocabulary	point source pollution, nonpoint pollution, riparian, sedimentation, permeable, denitrification and dichotomous key
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Setting	on the riparian buffer trail at Meadow Event Park, State Fair of Virginia or other suitable site
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Summary	Students review the many benefits vegetative buffers provide, make visual observations of the study area, and gain experience using a dichotomous key while identifying common riparian tree species.
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Learning Objectives	<p>Students will:</p> <ol style="list-style-type: none">1. strengthen their field observation skills by making general notations regarding the width of the buffer and the hydrology of the area including slope, channeling and soil erosion and deposition patterns.2. apply more detailed observations while making decisions inherent in the use of a tree identification key.3. understand the connection between hydrologic conditions and vegetative cover in determining a buffer's ability to prevent water pollution.
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Background Information	<p>Over one-third of our nation's streams, lakes and estuaries are impaired by some form of water pollution. Pollutants can enter surface waters from readily identified point sources such as industrial discharge pipes and wastewater treatment plants and less noticeable nonpoint sources including runoff from agricultural lands, mines, urban areas, construction sites and failed septic tanks. Vegetated riparian areas protect the adjacent waterway from land use activities that could harm water quality. They can:</p>
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- Hold soil in place and prevent erosion from bank
- Shade the stream to keep water cool for aquatic animals
- Provide organic matter to the stream as food and cover for animals
- Filter some pollutants out before they reach the water
- Provide wildlife habitats
- Provide areas for people to recreate

Sedimentation (the accelerated accumulation of soil and other materials in the waterway so that its average depth is reduced) can have a pronounced effect on water quality and stream life. Sediment can clog fish gills, suffocate fish eggs and insect larvae, and hinder organisms' ability to find food. In addition to the soil particles themselves, eroding sediments may transport other substances such as plant and animal wastes, nutrients, pesticides, petroleum products and metals into the waterway. Many factors influence the ability of the buffer to remove sediment from the land runoff, including

Background, continued

the width of the buffer, sediment size and volume, slope, type and density of riparian vegetation, the amount of organic matter on the ground, and the surface and subsurface drainage patterns. The most effective (water quality protection wise) riparian buffers tend to be at least 100 feet wide, on relatively flat land where water flows across the buffer in a more uniform sheet. If there is a clay or other less **permeable** layer within a few feet of the surface that keeps the water near the plant's roots that also helps.

The best trees for a riparian area are natives – those that were here before European settlers came to Virginia. Native plants are a natural part of the ecosystem, well-adapted to the local soils and climate. They grow well alongside other plants and provide for the needs of wildlife. Examples of native riparian area trees include the sweet gum, red maple, American sycamore, river birch and black willow. The quantity of leaf litter produced by the stand of trees affects the amount of carbon available to power **denitrification**, which is one of the primary ways the riparian buffer removes nitrogen from the system. During this process, nitrate from fertilizers and other sources is converted to a gas and released instead of getting into the water where it can cause algal blooms that can lead to low oxygen conditions. Grass filter strips or a combination of grasses, trees and other native plants can be used effectively in riparian buffers that are being managed to prevent a particular type of pollution. Thus, it is important for natural resource professional and land owners to know what type of trees and other plants they have growing on their waterfront property.

Materials

- One tree key for every two- or three-student team
- Flagging (lettered, tied to trees listed on the key in advance)
- Sheet of paper torn raggedly in half
- Laminated pictures or drawings of the leaves for those trees, if the field work is being conducted in early spring, late fall or winter
- Student data card for each student team (from journal)
- Clip board and pencil for each team
- Answer key to the Tree ID activity

Procedure

1. Ask the group what river they are standing near (North Anna). Explain to the group that they are in a riparian area – that is, land along the edge of a stream or river. Today, we will discuss reasons it is important to keep riparian areas vegetated and learn to identify some common riparian trees of Virginia. If time permits, we'll also learn about a tree that doesn't belong here, and see if we can find one.
2. Divide students into pairs or groups of three (based on the 5-member teams established by their teachers.) Hand out the student data cards, clip boards, pencils, tree keys and laminated leaf pictures (if needed.) Tell the students that we need to review the important terms on their data cards and tree keys before they disperse, so they will know how to complete the data collection.
3. Discuss the background information from this lesson, particularly what non-point pollution is and how a riparian buffers ability to protect water quality is influenced by the hydrology of the area and the type of vegetation growing there. Review what the terms: leaf litter/organic layer, slope, erosion, channeling and sedimentation mean. From where you stand, ask for volunteers to point out signs of these if possible. Explain that they will be making assessments regarding these features on their data cards. They won't be counting or taking measurements, but making visual observations and using relative terms like very steep, steep, moderately flat and flat. (During the course of the discussion, ask students to try to define the sub-watershed of the river. Can they list the ways (places) run-off is entering the system?)

Procedure, continued

4. Next, review the dichotomous tree key. “Dicho” means to divide into 2 groups in Latin. As the students proceed through the numbered steps of the key, they will have two options that take them forward. Their decisions will be based on the physical features of their assigned tree. Go over the directions written on the key. Before students start, discuss the following terms using paper or your body to model definitions:
 - *Opposite arrangement* – hold both arms out to your sides
 - *Alternate arrangement* – hold one arm straight out, bend other elbow in and hold out forearm
 - *Simple leaves* – hold out your hand with all fingers and thumb pressed close together
 - *Compound leaves* – hold out your hand with fingers spread wide to represent leaflets
 - *Lobes* – have students feel the shape of their earlobes
 - *Points* – show the corners of the paper
 - *Ragged edges or “teeth”* – show the torn edge of the paper
 - *Smooth edges* – show the intact edge of the paper

Explain to each team that they will be sent to a flagged tree. The letter on their assigned tree corresponds to the letter on their student data card. Before they begin identifying their tree, they need to answer the questions about the hydrology of the area. Tell them to search in a circular pattern, using an approximate 10 meter (20 paces) radius with their tree as the focal point or center of the circle. They can also use their vantage point on the bank to observe the river directly below them.
5. As they begin, assist them if they have questions about making the assessments and working through the tree key. Give each adult chaperone an answer key, so that teams can check their answers. Explain that the answers to the physical assessment questions are subjective which means they are open to interpretation or could be debated. When teams have completed their physical assessment and identified their tree correctly, they can try to ID a nearby tree while waiting for the other teams to finish.

Debriefing Activity

6. Call the group back together and discuss one or more of the following questions:
 - How did you rate this riparian buffer in terms of its ability to protect water quality?
 - What additional data or information do we need to make a more accurate assessment?
 - What was the most challenging part of using the tree key?
 - What did you find or learn that was unexpected?
 - What can we do to encourage more trees to grow in this riparian area?
7. Remind the students to make certain their names are on their journals and to keep track of them so they can be returned to their teacher.

Optional Supplemental Activity

- “Find the culprit!” – Use the “emergency bulletin” printed on the back of the data cards to set the stage for finding the Tree-of-Heaven.
8. When students have found an example of Tree-of-Heaven, ask what should be done about it? Foresters and other scientists believe Tree-of-Heaven should be removed so it will not spread. Invasive species like Tree-of-Heaven can change the entire ecosystem in ways we cannot predict. This could have a negative effect on all the connected parts: land, water, wildlife, and plants.

Resources

Virginia Cooperative Extension Publication 420-151 “Understanding the Science Behind Riparian Forest Buffers: Effect on Water Quality” 2000. Local VCE offices listed at www.ext.vt.edu

“Native Trees of Virginia” Virginia Department of Forestry, available at www.dof.virginia.gov

Riparian Buffer Data Card

Team Member Names:

What are the land uses uphill of this riparian area? (check all that apply)

☐ Crop Land ☐ Field/Pasture ☐ Residential ☐ Special Events
☐ Pave Parking Lot ☐ Forestry ☐ Commercial

How wide do you estimate this vegetated buffer to be? (on this side of the river)

☐ 0 to 25 ft. ☐ 25 to 50 ft. ☐ 50 to 75 ft. ☐ over 100 ft.

What is the relative slope of this area?

☐ Very Steep ☐ Steep ☐ Moderately Flat ☐ Flat

Compared to other forests you have walked in, how deep is the leaf litter / surface organic layer?

☐ Very Thick ☐ Thick ☐ Moderately Thin ☐ Very Thin or Sparse

How many areas of significant erosion do you see?

☐ Several ☐ A Few ☐ Next to None

Do you see evidence of channeling, where water has flowed across the buffer in little streams, that are getting deeper?

☐ Yes, a lot ☐ A little ☐ None at all

Do you see evidence of the buffer trapping sediment before it enters the river or sediment being dropped by the river when it floods?

☐ Yes, a lot ☐ A little ☐ None at all

Based on what you can see, how well do you think this riparian buffer protects the river from non-point pollution?

☐ Very well ☐ Moderately Well ☐ Not well

Your assigned tree's letter _____

What species is your tree? _____

Find the Culprit!

Local foresters are seeking your help in apprehending a tree that has escaped from captivity! It's a native of China, and it arrived here many years ago, posing as a pretty ornamental tree for cities and yards. It's now wanted on charges of outcompeting native trees and taking over their habitat, without even providing any decent food to wildlife. This tree is armed and dangerous – to other trees, that is. It produces a chemical that can keep other trees from growing nearby. It's also stinky!

This tree goes by the name *Ailanthus altissima*; alias: Tree-of-Heaven. We've reason to believe this tree is lurking here at this very site, waiting to infiltrate the forest. See if you can find one, based on this description.

- Alternate, compound leaves.
- Up to 25 leaflets on a leaf that may be several feet long!
- Smooth gray bark that may look a little like the skin of a cantaloupe.
- Big clusters of papery beige or pinkish seeds on female trees.
- Can reach 80 feet tall, but there may be some young ones growing nearby.
- If you break off and crush a leaflet, it smells bad.

Identification Key To Some Common Riparian Trees

Locate your assigned tree amongst those that are flagged. Start at number 1 on the key. Read both choices, and follow the directions based on your choice. When you reach a **name**, you have identified the tree! Enter the information on your team's student data card.

1. Tree has leaves → Go to 2, or
Tree has needles → Go to 3
2. Leaves are opposite (straight across from each other) → Go to 4, or
Leaves are alternate (not straight across from each other) → Go to 7
3. Needles are short and in bunches of two → **Virginia pine**, or
Needles are long and in bunches of 3 → **Loblolly pine**
4. Leaves are compound (divided into parts) → Go to 5
Leaves are simple (having only one part) → Go to 6
5. Most leaves have 3 to 5 leaflets → **Boxelder**, or
Most leaves have 7 to 9 leaflets → **Green ash**
6. Leaves have finely toothed edges and 3 to 5 main lobes → **Red maple**
Leaves are oval, with smooth edges → **Flowering dogwood**
7. Leaves are compound (divided into parts) → Go to 8, or
Leaves are simple (having only one part) → Go to 10
8. Leaflets are rounded leaflets; there may be "pods" on tree → **Black locust**
Leaflets are pointed; there may be nuts on the tree → Go to 9
9. Leaves have 10 to 24 pointed leaflets; nuts are larger than a golf ball → **Black walnut**, or
Leaves have 5 to 9 leaflets; nuts are smaller than a golf ball → a **Hickory** species
10. Leaves may be oval, mitten-shaped, or 3-lobed → **Sassafras**, or
All leaves are the same shape → Go to 11
11. Leaves are somewhat triangular, with toothed edges; bark is ragged and peeling → **River birch**, or
Leaves are some shape other than triangular → Go to 12
12. Leaves are narrow (less than 2 cm wide) and pointed → **Black willow**, or
Leaves are some other shape → Go to 13
13. Leaves are evergreen, thick, shiny, with sharp spines → **American holly**, or
Leaves are not evergreen or spiny → Go to 14
14. Leaves are oval, smooth edged, 7 to 11 inches long; tree is fairly small → **Pawpaw**, or
Leaves are lobed, with wavy or toothed edges → Go to 15
15. Leaves have wavy, rounded lobes; acorns may be present; bark is pale and shaggy → **Swamp Chestnut Oak**, or
Leaves have several main lobes or points → Go to 16
16. Leaves have 4 to 6 pointed lobes and smooth edges → **Yellow-poplar**, or
Leaves have 3 to 5 main points and ragged edges; bark is a mixture of brown, gray, and white near the top, with some peeling areas → **Sycamore**